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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/881,908	06/15/2001	Soon-Bin Jung	TJK/182/ L.W.	8188

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EXAMINER
ALEJANDRO MULERO, LUZ L

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 09/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/881,908	JUNG ET AL.	
	Examiner	Art Unit	
	Luz L. Alejandro	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 July 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) *1-6* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 7-8, 10-16, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Lee et al., U.S. Patent 6,288,493, and Collins et al., U.S. Patent 5,556,501.

Schneider et al. shows the invention substantially as claimed including a high density plasma processing apparatus generating a plasma, the apparatus comprising: a processing chamber providing hermetically sealed plasma generating space and having a planar surface on a top wall (see figs. 10 and 29); a gas inlet system; a plasma

electrode 236 (see figs. 10 and 29, and col. 25, lines 40-42) receiving high frequency power and being installed on the planar surface of the top wall of the processing chamber; an antenna coil 180 installed on a surface of the top wall except the planar surface and receiving a second high frequency power; a means for heating the antenna coil; and a means for fixing the substrate inside the processing chamber parallel with the planar surface of the top wall of the processing chamber.

Schneider et al. does not expressly disclose: a) a plurality of gas pipes to inject the process gases, b) that the antenna includes a plurality of loop-shape antennas, c) a plurality of variable capacitors connected in parallel with the plurality of antennas, and d) that a heat exchange medium is used as the means for heating the antenna coil.

Singh et al. discloses a plasma processing apparatus in which a plurality of gas pipes 160 and 172 are use to inject the gases into the processing chamber, and wherein at least one gas pipe surrounds the means for fixing the substrate in a shape of a ring and the end of the gas pipe bends toward and over the means for fixing the substrate so as to inject the gases upward (see fig. 3). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of gas pipes in order to supply secondary gas to the processing chamber and to improve process uniformity (see col. 5, lines 15-41 of Singh et al.).

Lee et al. discloses an inductive plasma processing apparatus which comprises a plurality of concentric antenna coils connected in parallel with each other and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils

in order to maintain a resonance state therebetween (see the abstract and figs. 3A, 3B and 5, and their descriptions). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of antenna coils connected in parallel with each other and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils in order to maintain a resonance state therebetween and maintain a constant plasma throughout the chamber.

Collins et al. discloses a plasma processing apparatus in which the antenna coil is hollow and is heated by circulating a heat exchange medium therein (see col. 21, lines 32-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise antenna coils that are hollow and to circulate a heat exchange medium through the antenna coils because such structure is known and suitable for heating the antenna coil. Furthermore, with respect to claim 13, the antenna heating means of Collins et al., is capable of heating in the claimed temperature range. Concerning claim 14, note in Collins et al. that the exhaust pipe 95 is used in order to emit the heat exchanging medium outside the member and then recirculate the heat exchange medium back into the member (see col. 21-lines 15-24 and fig. 1).

With respect to claim 16, note that Schneider et al. discloses an apparatus in the form of a truncated cone (see fig. 14).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Lee et al., U.S. Patent 6,288,493, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 19 above, and further in view of Hama et al., U.S. Patent 5,525,156.

Schneider et al., Singh et al., Lee et al., and Collins et al. are applied as above but do not disclose that the antenna coli are made of silver-coated aluminum. Hama et al. discloses the use of both silver and aluminum as desirable antenna coil materials (see col. 6, lines 48-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Lee et al., and Collins et al., as to include a silver plated aluminum antenna coil because this will produce a more resistant and cost effective antenna, since aluminum is an inexpensive material while silver is an expensive and highly resistant material.

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Lee et al., U.S. Patent 6,288,493, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 19 above, and further in view of Fairbairn et al., U.S. Patent 5,614,055.

Schneider et al., Singh et al., Lee et al., and Collins et al. are applied as above but fail to expressly disclose wherein the means for fixing the substrate is connected to a RF power supply to receive a high frequency of 2 to 4 MHz. Fairbairn et al. discloses

an RF source 90 which is applied to means for fixing a substrate and can be at a frequency of from 400kHz to 20 MHz (see col. 8-lines 42-67). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Lee et al., and Collins et al. because this is a suitable frequency to conduct inductive coupling processes.

Regarding claim 18, note that Schneider et al. discloses the application of RF power to the substrate electrode (see fig. 29).

Claims 7-8, 10-16, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Sato et al., U.S. Patent 5,907,221, and Collins et al., U.S. Patent 5,556,501.

Schneider et al. shows the invention substantially as claimed including a high density plasma processing apparatus generating a plasma, the apparatus comprising: a processing chamber providing hermetically sealed plasma generating space and having a planar surface on a top wall (see figs. 10 and 29); a gas inlet system; a plasma electrode 236 (see figs. 10 and 29, and col. 25, lines 40-42) receiving high frequency power and being installed on the planar surface of the top wall of the processing chamber; an antenna coil 180 installed on a surface of the top wall except the planar surface and receiving a second high frequency power; a means for heating the antenna coil; and a means for fixing the substrate inside the processing chamber parallel with the planar surface of the top wall of the processing chamber.

Schneider et al. does not expressly disclose: a) a plurality of gas pipes to inject the process gases, b) that the antenna includes a plurality of loop-shape antennas, c) a plurality of variable capacitors connected in parallel with the plurality of antennas, and d) that a heat exchange medium is used as the means for heating the antenna coil.

Singh et al. discloses a plasma processing apparatus in which a plurality of gas pipes 160 and 172 are use to inject the gases into the processing chamber, and wherein at least one gas pipe surrounds the means for fixing the substrate in a shape of a ring and the end of the gas pipe bends toward and over the means for fixing the substrate so as to inject the gases upward (see fig. 3). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of gas pipes in order to supply secondary gas to the processing chamber and to improve process uniformity (see col. 5, lines 15-41 of Singh et al.).

Sato et al. discloses an inductive plasma processing apparatus which comprises a plurality of antenna coils 150a-150g connected in parallel with each other and a plurality of variable capacitors 160A-160g that are connected in parallel with the plurality of the antenna coils (see fig. 6 and its description). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of antenna coils connected in parallel with each other and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils in order to independently tailor the plasma in different regions of the chamber, therefore, providing a perfectly

uniform plasma ion density distribution across the entire substrate surface under a large range of plasma processing conditions (see col. 1, lines 51-61).

Collins et al. discloses a plasma processing apparatus in which the antenna coil is hollow and is heated by circulating a heat exchange medium therein (see col. 21, lines 32-34). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise antenna coils that are hollow and to circulate a heat exchange medium through the antenna coils because such structure is known and suitable for heating the antenna coil. Regarding claim 13, the antenna heating means of Collins et al. is capable of heating in the claimed temperature range. Concerning claim 14, note in Collins et al. that the exhaust pipe 95 is used in order to emit the heat exchanging medium outside the member and then recirculate the heat exchange medium back into the member (see col. 21-lines 15-24 and fig. 1).

With respect to claim 16, note that Schneider et al. discloses an apparatus in the form of a truncated cone (see fig. 14).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Sato et al., U.S. Patent 5,907,221, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 19 above, and further in view of Hama et al., U.S. Patent 5,525,156.

Schneider et al., Singh et al., Sato et al., and Collins et al. are applied as above but do not disclose that the antenna coil are made of silver-coated aluminum. Hama et

al. discloses the use of both silver and aluminum as desirable antenna coil materials (see col. 6, lines 48-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Sato et al., and Collins et al., as to include a silver plated aluminum antenna coil because this will produce a more resistant and cost effective antenna, since aluminum is an inexpensive material while silver is an expensive and highly resistant material.

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Sato et al., U.S. Patent 5,907,221, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 18-19 above, and further in view of Fairbairn et al., U.S. Patent 5,614,055.

Schneider et al., Singh et al., Sato et al., and Collins et al. are applied as above but fail to expressly disclose wherein the means for fixing the substrate is connected to a RF power supply to receive a high frequency of 2 to 4 MHz. Fairbairn et al. discloses an RF source 90 which is applied to means for fixing a substrate and can be at a frequency of from 400kHz to 20 MHz (see col. 8-lines 42-67). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Sato et al., and Collins et al. because this is a suitable frequency to conduct inductive coupling processes.

Regarding claim 18, note that Schneider et al. discloses the application of RF power to the substrate electrode (see fig. 29).

Claims 7-8, 10-16, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Tomioka et al., U.S. Patent 5,897,713, and Collins et al., U.S. Patent 5,556,501.

Schneider et al. shows the invention substantially as claimed including a high density plasma processing apparatus generating a plasma, the apparatus comprising: a processing chamber providing hermetically sealed plasma generating space and having a planar surface on a top wall (see figs. 10 and 29); a gas inlet system; a plasma electrode 236 (see figs. 10 and 29, and col. 25, lines 40-42) receiving high frequency power and being installed on the planar surface of the top wall of the processing chamber; an antenna coil 180 installed on a surface of the top wall except the planar surface and receiving a second high frequency power; a means for heating the antenna coil; and a means for fixing the substrate inside the processing chamber parallel with the planar surface of the top wall of the processing chamber.

Schneider et al. does not expressly disclose: a) a plurality of gas pipes to inject the process gases, b) that the antenna includes a plurality of loop-shape antennas, c) a plurality of variable capacitors connected in parallel with the plurality of antennas, and d) that a heat exchange medium is used as the means for heating the antenna coil.

Singh et al. discloses a plasma processing apparatus in which a plurality of gas pipes 160 and 172 are use to inject the gases into the processing chamber, and wherein at least one gas pipe surrounds the means for fixing the substrate in a shape of a ring and the end of the gas pipe bends toward and over the means for fixing the substrate so as to inject the gases upward (see fig. 3). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of gas pipes in order to supply secondary gas to the processing chamber and to improve process uniformity (see col. 5, lines 15-41 of Singh et al.).

Tomioka et al. discloses an inductive plasma processing apparatus which comprises a plurality of concentric antenna coils 32,33 connected in parallel with each other and a plurality of variable capacitors 5,6,8,9 that are connected in parallel with the plurality of the antenna coils in order to better control the plasma generated inside the chamber (see figs. 4 and 5, and their descriptions). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise the claimed plurality of antenna coils connected in parallel with each other and a plurality of variable capacitors that are connected in parallel with the plurality of the antenna coils in order to better control the plasma generated inside the chamber.

Collins et al. discloses a plasma processing apparatus in which the antenna coil is hollow and is heated by circulating a heat exchange medium therein (see col. 21, lines 32-34). Therefore, it would have been obvious to one having ordinary skill in the

art at the time the invention was made to modify the apparatus of Schneider et al. as to comprise antenna coils that are hollow and to circulate a heat exchange medium through the antenna coils because such structure is known and suitable for heating the antenna coil. Regarding claim 13, the antenna heating means of Collins et al. is capable of heating in the claimed temperature range. Concerning claim 14, note in Collins et al. that the exhaust pipe 95 is used in order to emit the heat exchanging medium outside the member and then recirculate the heat exchange medium back into the member (see col. 21-lines 15-24 and fig. 1).

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Schneider et al., Singh et al., Tomioka et al., and Collins et al. are applied as above but do not disclose that the antenna coil are made of silver-coated aluminum. Hama et al. discloses the use of both silver and aluminum as desirable antenna coil materials (see col. 6, lines 48-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Tomioka et al., and Collins et al., as to include a silver plated aluminum antenna coil because this will produce a more resistant and

cost effective antenna, since aluminum is an inexpensive material while silver is an expensive and highly resistant material.

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schneider et al., EP 0838841 A2 in view of Singh et al., U.S. Patent 6,042,687, Tomioka et al., U.S. Patent 5,897,713, and Collins et al., U.S. Patent 5,556,501, as applied to claims 7-8, 10-16, and 19 above, and further in view of Fairbairn et al., U.S. Patent 5,614,055.

Schneider et al., Singh et al., Tomioka et al., and Collins et al. are applied as above but fail to expressly disclose wherein the means for fixing the substrate is connected to a RF power supply to receive a high frequency of 2 to 4 MHz. Fairbairn et al. discloses an RF source 90 which is applied to means for fixing a substrate and can be at a frequency of from 400kHz to 20 MHz (see col. 8-lines 42-67). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Schneider et al. modified by Singh et al., Tomioka et al., and Collins et al. because this is a suitable frequency to conduct inductive coupling processes.

Regarding claim 18, note that Schneider et al. discloses the application of RF power to the substrate electrode (see fig. 29).

Response to Arguments

Applicant's arguments filed 7/8/03 have been fully considered but they are not persuasive. Applicant argues that Schneider et al. fails to provide means for heating an antenna coil as noted in the office action. However, the examiner respectfully submits that in the abstract of Schneider et al., for example, it is clearly stated that a flexible heater can be wrapped around the dome inside the RF coil. Collins et al. '501 is used to show controlling the temperature of a dome by circulating a heat exchange medium through the antenna coils. For these reasons, it is respectfully submitted that the rejection is proper and is respectfully maintained.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 703-305-4545. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on 703-308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Luz L. Alejandro
Primary Examiner
Art Unit 1763

September 22, 2003